



Southeastern Pennsylvania Transportation Authority

Electric Traction Instructions

ET 001

For the Government of all SEPTA
Railroad Division
Train & Engine Service Personnel,
Train Dispatchers, Towerpersons, Facilities
Personnel, R.E.D. Personnel, Supervisors,
and Employees of Foreign Railroads
Operating on SEPTA Territory

Revised July 1, 1990

NOTICE

These instructions govern SEPTA Railroad Division Train & Engine Service employees, Train Dispatchers, Towerpersons, Facilities personnel, Rail Equipment Department personnel, and Supervisory personnel whose duties involve the movement of trains in electrified territory. These instructions also govern employees of foreign railroads performing service in SEPTA electrified territory.

All such employees must maintain a current copy of these instructions, and carry these instructions with them while performing duty.

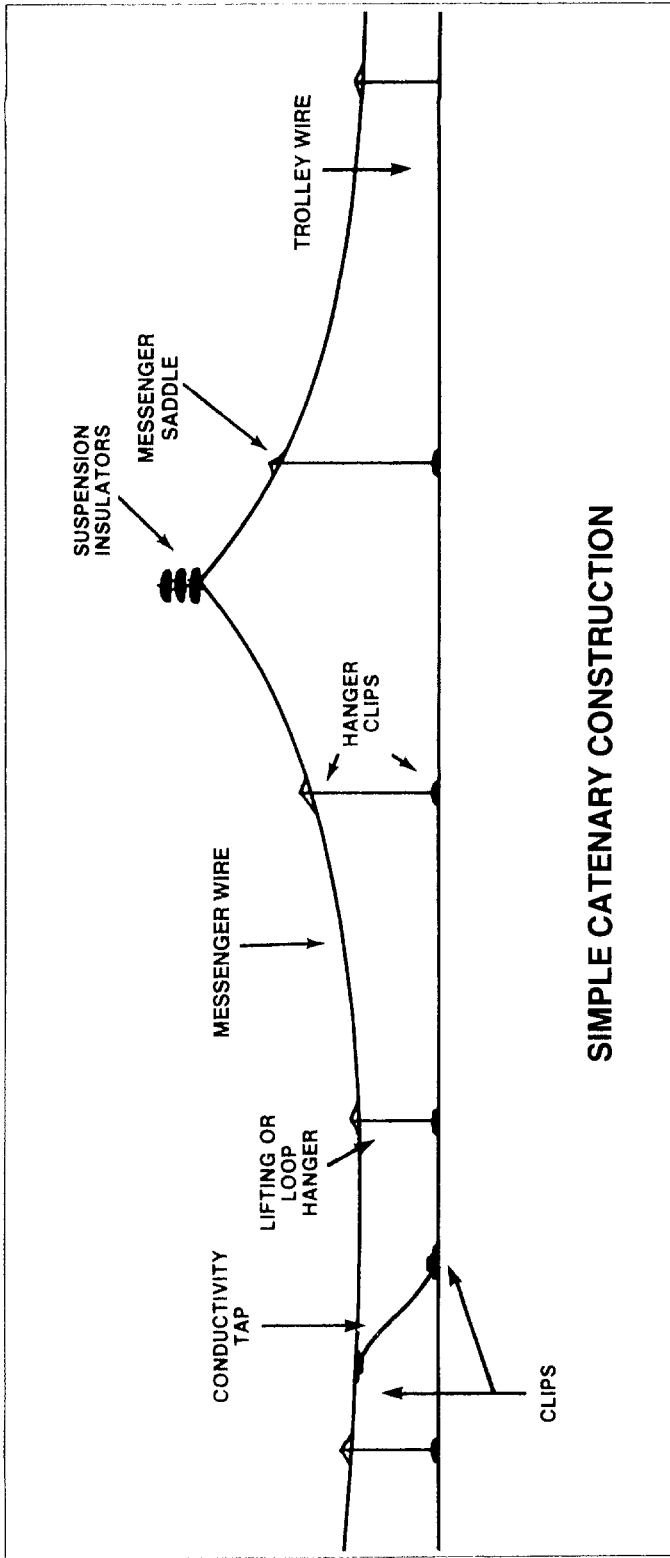
These instructions are issued for the protection of such employees and property, and for the operation of trains in SEPTA maintained electrified territory.

Safety is of the first importance in the discharge of duty. Employees governed by these instructions must be conversant with them and obey them. Obedience to them is essential to safety. Constant care must be exercised to guard against personal injury, loss of life, or damage to property.

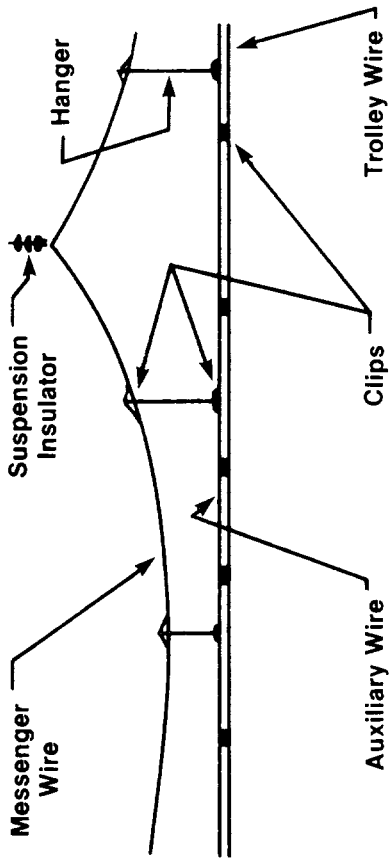
Employees must be familiar with all illustrations. If in doubt as to their meaning, employees must apply to the proper authority for explanation.

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SIMPLE CATENARY CONSTRUCTION



CATENARY IDENTIFICATION

COMPOUND CATENARY

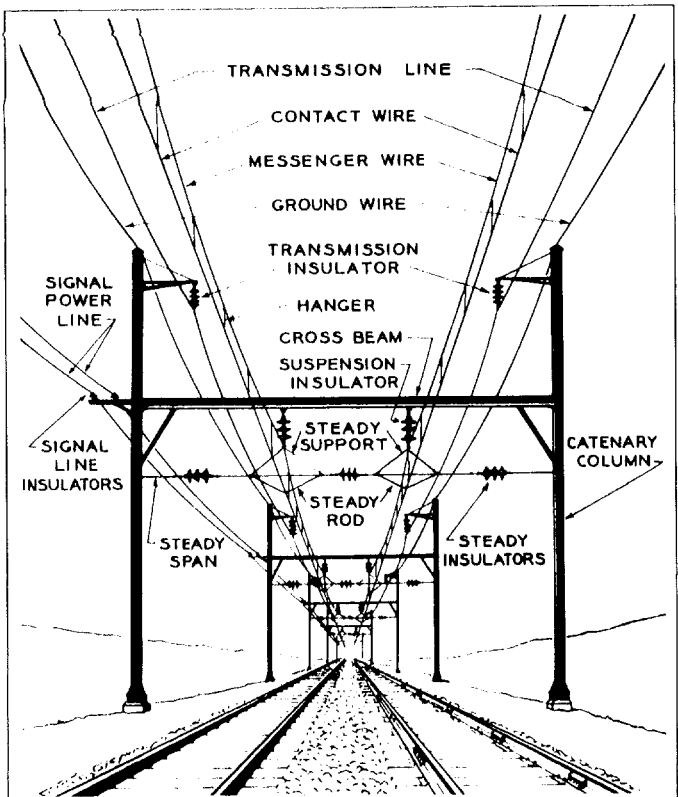
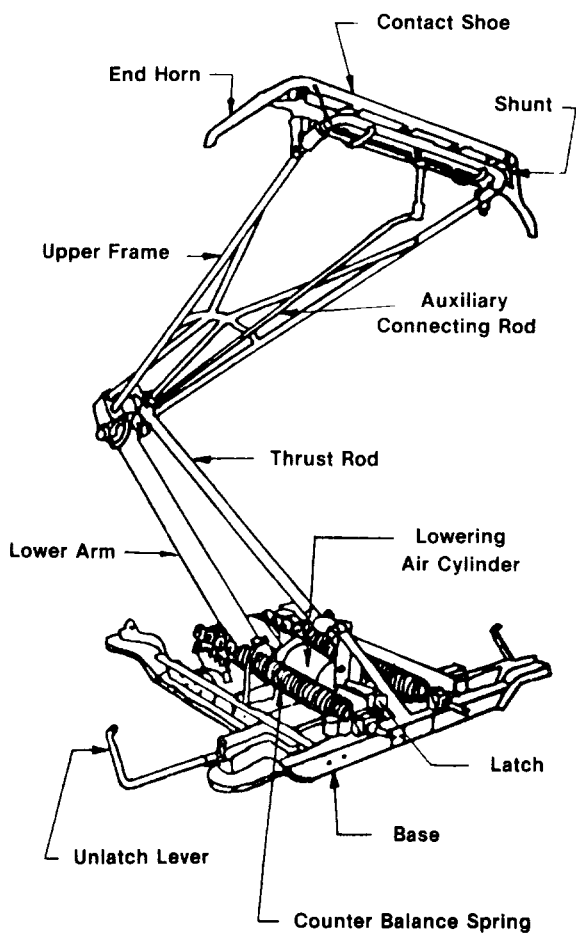


Figure 1. Overhead Electrification.

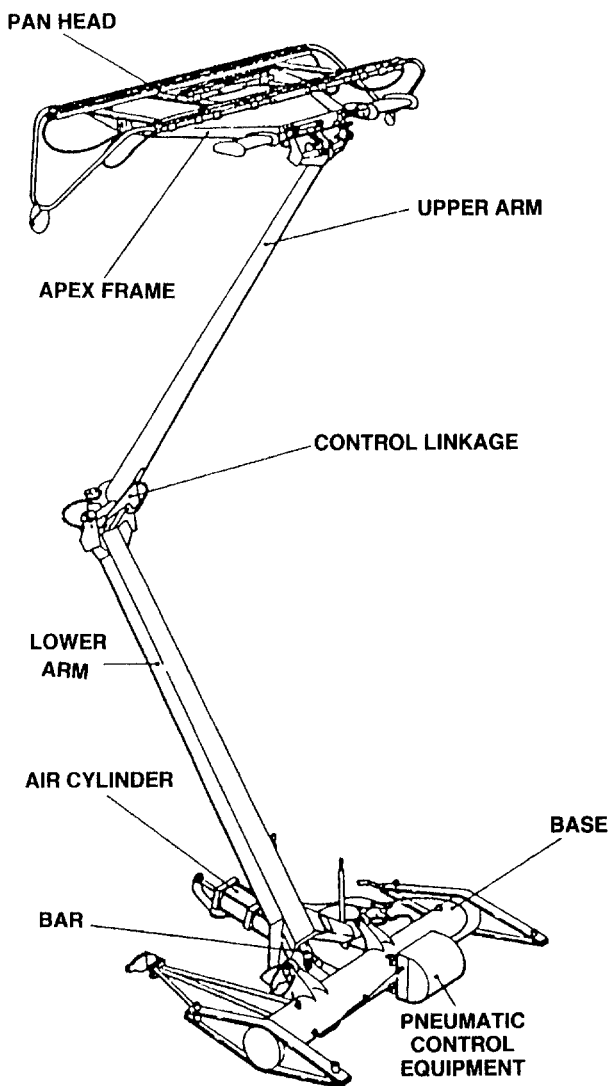
FAIVELEY PANTOGRAPH



EQUIPMENT APPLICATION:

1. SILVERLINER II (BUDD)
2. SILVERLINER III (ST. LOUIS)
3. SILVERLINER IV (GENERAL ELECTRIC)

BRECKNELL-WILLIS HI-SPEED PANTOGRAPH



EQUIPMENT APPLICATION:
1. AEM 7 LOCOMOTIVE

STANDARD WARNING TAG

DO NOT OPERATE

THIS SWITCH OR APPARATUS



MEN WORKING ON LINE

When this tag has served its purpose and is properly filled out, it must be sent to _____

PRINTED IN U.S.A.

C&S 105 REV. 1-81

SEPTA

PERMIT NO. _____



Apparatus of Circuit No. _____

Person in charge _____

Nature of work _____

Tag placed by _____ Time _____ Date _____

Tag removed by _____ Time _____ Date _____

Location _____ Date _____ 19 _____

OPERATION

OPEN | TIME

OCB

KNF

KNF

ON

SC&G

OFF

CLOSED

KNF

KNF

OCB

GENERAL DEFINITIONS

Arc. A luminous and destructive flash or flame in or about the wires, or electric apparatus.

Bus Jumper. A High Voltage (about 32 volts) cable or jumper used to transmit power from one unit to another.

Catenary System. A system of wires suspended between poles and bridges supporting and including the overhead contact wires which are energized at 11,000 volts, 25Hz. All conductors and hardware below or between insulators are normally energized.

Circuit. The complete path over which electric current is transmitted from and returned to its source.

Circuit Breaker. A device which operates automatically or manually to protect, energize or de-energize transmission lines, signal power lines, catenary system, etc.

Contact (Trolley) Wire. The overhead wire from which the pantograph collects current.

Control Jumper. A low voltage multi-circuit cable or jumper used between multiple unit cars to transmit control.

De-energized. Disconnected from the normal power source. Electric apparatus, such as overhead wires, transformers, switches, motors, pantographs, etc., is dangerous to life until properly grounded, or other approved protection is provided.

Electric Equipment. Electric equipment, as used herein, refers to engines and cars operated by power received from an overhead contact wire.

Electrified Territory. That portion of the railroad equipped for electric train operation powered by the catenary system.

Emergency Conditions. A circumstance which prevents or interferes with normal operation of trains, or presents a hazard to life or equipment.

Energized—Live (Dangerous to Life). Electric apparatus, such as overhead wires, cables, transformers, switches, motors, pantographs, etc., connected to a power source, or exposed to a source of induction.

General Superintendent/Operations. When referred to in these instructions, the General Superintendent/Operations will be represented by the Train Dispatcher.

Ground. An electrical connection made to the rail or other earth potential which will prevent the build-up of voltages in electrical apparatus, such as overhead wires, transformers, switches, motors, pantographs, etc., which might result in hazard to personnel or equipment.

Grounding Switch. A device which is closed to connect wires or electric apparatus metallically to the rail return circuit.

Multiple Unit Car. Electrically powered passenger cars so equipped that the motors on all cars in the train may be operated from any control station on the train.

Pantograph. A device located on top of electric equipment which collects power from the overhead contact wire by means of a sliding contact shoe.

Pantograph Pole. An insulated pole with a metal hook at one end, designed to manually raise or lower a pantograph.

Phase Break (or Gap). A location where overhead wires are arranged to provide an insulated section between different sources of A. C. power. There is no overlap of circuits.

Properly Grounded Circuit. A circuit or apparatus may be considered properly grounded and safe to work on when grounds, applied by qualified personnel, are visible on both sides of the work area, or, if a class A employee, assigned to protection duty, indicates that grounds have been applied.

Power. The term meaning electrical energy used for traction or signals.

Power Dispatcher. The Power Dispatcher is in charge of power distribution. He will de-energize circuits under **emergency conditions** at his discretion, otherwise, upon permission of the Train Dispatcher. He will energize a circuit upon release of any permits outstanding against that circuit or, after an opening due to a fault, at his discretion. His decision will supercede all but his staff superiors who will assume responsibility for the closure. A staff superior, for these purposes, is defined as a Railroad Power Group "A" payroll supervisor.

Qualified Employees. Employees who have passed the required examinations and have been approved by proper authority are classified as follows:

Class A.—Railroad Power Group employees qualified to erect, repair and maintain electric apparatus and catenary, or to supervise and protect other persons performing work in electrified territory. These employees are also qualified to use hot line tools and work on circuits energized to 138,000 volts.

Class B.—Other Railroad Power Group or R.E.D. employees who have been instructed and certified on electrical hazards and are allowed on top of equipment when authorized in these instructions.

Section Break. (Air Break or "Wood Stick") A location where overhead wires are arranged to provide separation of circuits and yet permit continuous collection of current. There is a point in a section break which momentarily ties the adjacent circuits together.

Sectionalizing Switch. A device which is closed to energize or connect and opened to de-energize or separate a section or sections of the catenary system, signal power lines, etc.

Substation. A location where power is received at high voltage and changed to required voltages and characteristics for distribution to the catenary system, and other electric apparatus. It may contain transformers, rotating machinery, circuit breakers, sectionalizing switches, rectifiers, etc.

Switching Station. A location where power is received and distributed at the same voltage.

Transformer. A device used to increase or decrease AC voltage.

Transmission Lines. A system of wires or cables, or both, used to transmit power at high voltage between substations.

SECTION 1. INSTRUCTIONS PERTAINING TO ALL EMPLOYEES

1.1 SEPTA TERRITORIES. These instructions apply to all electric traction systems maintained by SEPTA. These include:

1. Main Line (30th Street to Dale), including Powelton Avenue Yard, Roberts Avenue Yard, and Wayne Junction Electric Car Yard
2. Norristown Line
3. Chestnut Hill East Line
4. Conrail Trenton Line (CP—Newtown Jct. to CP—Cheltenham Jct, and Neshaminy to Trent)
5. Fox Chase Line
6. Neshaminy Line
7. Warminster Line
8. Doylestown Line
9. Airport Line
10. West Chester Line
11. Ivy Ridge Line
12. Chestnut Hill West Line
13. Paoli Yard
14. Frazer Yard

1.2 AMTRAK TERRITORIES. For instructions pertaining to AMTRAK territories, see Amtrak Electrical Operating Instructions AMT-2.

1.3 OCCURRENCES AND CONDITIONS. All occurrences which are likely to affect electrical operation must be reported immediately to the Train Dispatcher or Power Dispatcher.

The following are conditions which are likely to affect electrical operation and must be reported immediately:

1. Broken or loose wires,
2. Attachments out of place,
3. Foreign objects of any kind,
4. Damaged cross arms,
5. Trespassers on or around catenary structures or substations.

In describing such conditions, the proper names and locations of the parts involved should be used. (Refer to illustration pages for names of parts.)

1.4 DANGLING WIRES/FOREIGN OBJECTS. Employees must not touch dangling wires or foreign objects hanging from electric wires nor attempt to remove them by any means. When encountering downed catenary wires, a distance of at least ten (10) feet must be maintained. Employees must report the location immediately to the Train Dispatcher and, when practicable, leave someone to provide protection for other persons.

1.5 BROKEN IMPEDANCE BONDS. Loose or broken impedance bond connections must be regarded as energized and reported immediately to the Train Dispatcher.

1.6 TRACKS OBSTRUCTED. When an overhead wire failure occurs that may obstruct tracks, all tracks that may be affected must be protected immediately.

1.7 POTENTIAL DAMAGE TO PANTOGRAPHS. When a broken wire or obstruction in overhead catenary is found which may damage a pantograph, a signal to drop pantographs (NORAC Operating Rule 12[g]) must be given to approaching electric equipment on the track involved.

When this signal is received, it must be acknowledged at once by two short sounds of the engine whistle, and then pantographs must be dropped immediately. After passing the break or obstruction, pantograph(s) may be raised. The signal may also be used to indicate when pantographs may be raised safely.

- 1.8 EMERGENCIES.** When necessary to de-energize overhead wires to prevent loss of life or damage to property, the Power Dispatcher must be notified immediately. Persons notifying the Power Dispatcher must await for further instructions.

In the event of extreme emergencies, if using railroad telephone line or radio, the words "POWER EMERGENCY" must be repeated three (3) times. All others using line or channel must yield immediately.

The Bell Telephone numbers of Power Dispatchers are as follows:

SEPTA Power Dispatcher (215) 580-6844
AMTRAK Power Director, 30th Street (215) 895-7435
AMTRAK Power Director, Harrisburg (717) 232-3319

- 1.9 DE-ENERGIZING A SECTION.** When it is necessary that a section of catenary must be de-energized to perform work, operating or maintenance employees will communicate with the Power Dispatcher who will arrange for de-energization and protection. Except under emergency conditions, at least a one day notice is required. (Also refer to 1.13 and 1.14.)

- 1.10 DEFECTIVE PANTOGRAPHS.** The condition of pantographs should be observed frequently. Any defects to pantographs must be reported to the Train Dispatcher immediately. Train and Engine Service personnel are responsible for taking corrective action immediately once defective conditions are known.

- 1.11 OCCUPYING ROOF OF EQUIPMENT.** Only Class A and Class B Electric Traction Department employees, and Class B Rail Equipment Department employees are permitted to occupy the roof of electric equipment.

- 1.12 DERAILED EQUIPMENT.** When electric equipment is derailed and contact is broken with rail return circuit, the electric equipment must be considered energized. Pantographs must be dropped immediately and grounding bars (switches) closed. Until catenary has been de-energized and grounded, or until pantographs have been dropped and grounded, all persons not occupying the equipment must maintain a distance of at least three (3) feet from the derailed equipment.

Crew members shall inform all passengers and employees not to board or discharge from the equipment until the pantograph is lowered or the overhead wire is de-energized and grounded. Crew members shall not leave the equipment in a manner which permits simultaneous contact with the equipment and earth, and shall prevent anyone else from doing so.

- 1.13 WORKING NEAR OVERHEAD WIRES OR APPARATUS.** Only qualified railroad personnel are permitted to work near overhead wires or apparatus. Employees of other agencies may be permitted to work only when protected by a Class A employee who will take the necessary precautions for their safety before starting the work and during the progress of their work.

1.14 SAFE DISTANCE FROM WIRES. Unless wires have been de-energized and grounded, and unless protected by a Class A employee, all persons (except Class A employees) must stay at least three (3) feet away from signal power or catenary wires, and at least eight (8) feet away from transmission or 24KV feeder wires.

1.15 OCCUPYING RAILROAD EQUIPMENT UNDER CATENARY WIRES. All employees other than Class A or Class B employees are prohibited from getting on, riding on, or working on the top or roof of any freight car, passenger car, caboose, engine, or other high railroad equipment or high lading while such equipment is under the energized catenary system.

1.16 USE OF PANTOGRAPH POLES. Pantograph poles are carried on all electric equipment. After use (unless damaged) poles should be returned to the proper receptacles. Poles must not be left along tracks. Any poles found along the right-of-way should be returned for cleaning and testing to the Electric Car Shop, Wayne Jct. If not practicable, Train Dispatcher should be notified of location.

When it is necessary to use the pantograph pole to manually raise or lower the pantograph, the pole shall be used in the following manner:

1. The pole must be clean and dry.
2. Hands must be kept at least six (6) feet from the hook end of the pole, or kept below the warning mark.
3. The pole must be kept clear of your clothing and your body.
4. The pole must be pivoted (rested against) the edge of the roof of the car.

1.17 SECTIONALIZING SWITCHES AND CIRCUIT BREAKERS. Circuit breakers (generally located in substations) and sectionalizing switches (generally located along the right-of-way on catenary structures) are under the jurisdiction of the Power Dispatcher, and are utilized at his discretion to divide the catenary system into sections. Only Class A Electric Traction employees are permitted to operate hand sectionalizing switches or circuit breakers which are located along the right-of-way on catenary structures.

1.18 RESPONSIBILITY OF FOREMEN. Foremen are responsible for knowing that their men understand and comply with these instructions for electrical operation. When inexperienced men are required to work in electrified territory, foreman must call their attention to the dangers.

1.19 DE-ENERGIZED SECTIONS. Trains must not be operated into, or out of de-energized sections with any pantographs in the "raised" position.

1.20 ITEMS PROHIBITED AROUND WIRES. Wire, wet rope, steel tape line, or linen tape line containing metallic reinforcement must not be used around energized wire, apparatus, or equipment.

1.21 ENTERING SUBSTATIONS. Only employees who have been authorized by the Power Dispatcher may enter electrical substations, power plant enclosures or buildings.

SECTION 2. INSTRUCTIONS PERTAINING TO TRAIN & ENGINE SERVICE PERSONNEL

2.1 NUMBER OF CARS IN MULTIPLE UNIT (MU) EQUIPMENT CONSISTS. Multiple Unit Silverliner II, III, and IV car consists are limited to the following:

1. Six (6) cars in revenue service and eight (8) cars in non-revenue service except:
 - a. West Chester Line (Lenni to West Chester) - 8 cars
 - b. Chestnut Hill West Line - 12 cars
 - c. Airport Line - 4 cars
 - d. Main Line (between Powelton Ave. Yard and Suburban Station) - 12 cars (non-revenue service only)
 - e. Main Line (between Suburban Station and Wayne Electric Car Yard) - 10 cars (non-revenue service only)

2.2 PROPER PROCEDURE FOR RAISING PANTOGRAPHS ON MU EQUIPMENT. To prevent catenary damage caused by pantographs raising too quickly, the following procedure must be followed whenever pantographs are raised:

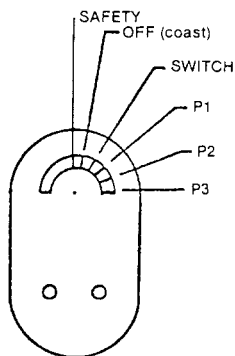
1. Place trainline DOWN PANTOGRAPH switch in the "Down" position;
2. While switch is in "Down" position, push in trainline PANTOGRAPH RAISE button;
3. While holding in button, place trainline DOWN PANTOGRAPH switch in the "Normal" position until pantograph engages wire.

2.3 POWER SHORTAGES (P1 & P2 ORDERS). In the event of traction power shortage, the Power Dispatcher will instruct the Train Dispatcher to issue verbal instructions via radio to all train and engine service personnel to operate trains in throttle positions which are less than full power. These instructions will be verbalized as either the "P1" power position, or the "P2" power position for either the MU Master Controller, cab Car throttle, or AEM-7 throttle. Instructions must be issued every two (2) minutes until cancelled.

For AEM-7 equipment, the "P1" power position is number "2" on the throttle; the "P2" power position is number "5" on the throttle.

For Cab Car equipment, the "P1" power position is number "2" on the throttle; the "P2" power position is number "4" on the throttle.

For Silverliner II, III, or IV equipment, refer to the following diagram for power positions:



A "P1" or "P2" power order will remain in effect until cancelled by the Train Dispatcher upon authority of the Power Dispatcher.

- 2.4 END OF CONTACT WIRE.** Sign will indicate the end of contact wire. Electric equipment must not pass the sign with pantograph in the "raised" position. The following signs are used to indicate end of contact wire:

**END OF
CONTACT WIRE**

**ELECTRIC TRAIN
STOP**

**AC
MOTOR
STOP**

- 2.5 DE-ENERGIZING TRACK OCCUPIED BY EQUIPMENT.** If it becomes necessary to de-energize the overhead contact wire while track is occupied by electric equipment, crew members will be instructed to drop pantograph(s) (when possible).

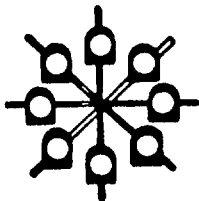
- 2.6 PHASE BREAKS.** Phase breaks are located as specified in the Timetable Special Instructions.

Phase breaks are also indicated by the following:

Phase break sign, which is located on first catenary pole prior to reaching phase break.

PB

Phase break position light indicator, which is located prior to reaching the phase break sign.



When phase break indicator is lighted, a section of the phase break is de-energized and all electric trains approaching a phase break on any track must be operated as follows:

1. Controller must be placed in the "OFF" position at the "PB" sign and kept in that position until after the phase break is passed.

2. If a speed of 15 MPH or more cannot be maintained while entire train is passing under phase break, pantograph(s) must be dropped until clear of phase break.
3. If number signs are installed beyond the phase break (to indicate car lengths), power should not be reapplied until sign corresponding to number of cars in the train consist is passed by the leading car of the train. **(NOTE: Also see Timetable Special Instruction for Main Line, Item 5. AC ELECTRICAL OPERATING INSTRUCTIONS)**

In the event that a train is stopped under a phase break, all pantographs must be dropped. Only those pantographs which can then be raised outside the phase break area in the direction of travel may be raised to allow movement out of the area. If a train with one pantograph is stopped under a phase break area, it must be moved with other equipment.

- 2.7 MOVEMENT OF DEAD ELECTRIC EQUIPMENT.** When electric equipment is hauled dead-in-tow, all grounding switches must be fully closed and locking pins inserted (when provided). If pantographs are damaged, pantographs must be secured (tied down) with no parts extending above the lock-down height.

If dead-in-tow equipment must be moved between electrified territory and non-electrified territory, pantographs must be down, grounding switches closed, and locking pins inserted (when provided).

If dead-in-tow MU equipment must be hauled in a freight train, cars must be placed to rear of train.

- 2.8 RAISING AND LOWERING OF PANTOGRAPHS IN TUNNEL AREAS.** When trains are located in tunnel areas or other areas of close catenary clearance (as specified in Timetable Special Instructions), pantographs must not be raised or lowered unless catenary power is removed.

- 2.9 MOVEMENT PERMIT FORM D INSTRUCTIONS TO DROP PANTOGRAPHS.** When it has been determined that electric equipment can be safely operated with pantographs in the down position under catenary wire that has been damaged, the Train Dispatcher must issue instructions on Movement Permit Form D, Line 13. The information must include the affected track(s), and the limits of the territory through which the pantographs must be kept in the down position.

Engineers, prior to entering territory specified on the Movement Permit Form D, must make a test of the pantograph lowering switch to assure that the pantograph drops. If pantograph fails to lower, movement must stop and the Train Dispatcher must be notified immediately.

Engineer must place control throttle in the "off" position before dropping or raising pantograph. Engineer must keep DOWN Pantograph switch in the "down" or "lowered" position while operating through the area specified on the Movement Permit Form D.

If pantograph fails to lower when engineer enters territory affected by the drop pantograph instructions, movement must stop immediately and the Train Dispatcher notified.

Engineer must not raise pantograph when equipment is adjacent to a turnout or crossover to prevent "bouncing" the wires which are over adjacent tracks.

- 2.10 LOSS OF CATENARY POWER.** When standing electric equipment loses power, or when moving electric equipment loses power and comes to a stop before power is restored, the Train Dispatcher must be notified.
- 2.11 LOSS OF POWER DUE TO PLR TRIP.** When pantograph has lowered due to the operation of the Pantograph Lowering Relay (PLR), pantographs must not be raised until permission has been obtained from the Power Dispatcher.
- The PLR may only be reset one time. If PLR trips the second time, pantograph must not be raised again. The manual grounding switch must be closed and the locking pin inserted (where provided).
- 2.12 PERIODS OF HIGH WINDS.** During periods of high winds, engineers will observe the action of pantographs and the catenary to the extent possible. When it appears that a slower speed will be more practical, they will reduce speed and immediately notify the Train Dispatcher of such condition.
- 2.13 VISIBLE DEFECTS OR CONDITIONS.** When there are visible defects or conditions which may damage pantographs or catenary, or which may cause danger to persons on or around tracks under the overhead wires, pantographs must be dropped and the Train Dispatcher notified immediately.
- 2.14 DAMAGED PANTOGRAPHS.** If pantographs become damaged or broken, electric equipment must be stopped immediately and report made to the Train Dispatcher. Equipment must not be moved until all broken pantographs are removed, or properly isolated and secured so that no part can come into contact with overhead wire or with equipment on adjacent tracks.
- 2.15 TWO OR MORE TRAINS STOPPED ON SAME TRACK IN CLOSE PROXIMITY.** Whenever two or more trains are stopped on the same track a short distance apart, the following train must wait a minimum of thirty (30) seconds before starting after the preceding train has started.
- 2.16 USE OF PILOT IN ELECTRIFIED TERRITORY.** When a pilot is assigned to a train which is to operate in electrified territory, the pilot must promptly: 1) notify the crew members that they are operating in electrified territory, and 2) instruct crew members to keep off the top of equipment under overhead catenary wires.
- 2.17 LOADING/UNLOADING FREIGHT CARS IN ELECTRIFIED TERRITORY.** When loading or unloading any freight cars containing long material which has the potential to come in contact with overhead catenary wires, arrangement must be made to de-energize the wire.
- Until wire has been de-energized, all persons must be kept from going on top of high lading or onto the roof of such freight cars until the catenary system has been properly grounded. After the system has been grounded, all persons engaging in the loading or unloading of such cars must be warned to regard all overhead wires as energized, and must not allow any part of their bodies or other material to come into contact with the wires.
- 2.18 INSTRUCTIONS FOR OPERATION DURING SLEET.** Engineers must be on the alert for excessive arcing caused by sleet formation on catenary overhead wires. The first indication of sleet shall be reported to the Train Dispatcher

who must issue special pantograph instructions when conditions warrant.

When wire is heavily coated with sleet, speed should be reduced to thirty (30) mph in order to effect removal of sleet from the contact wire with minimal wear on pantograph shoes.

When special pantograph instructions are in effect, Hi/Low pantograph switch must be placed in "Hi" position.

Electric locomotives (i.e. AEM-7 engines) equipped with two pantographs shall run with both pantographs up on leading engine and rear pantographs up on each trailing engine, except through phase break and dead sections. Engineer should make certain that lead pantograph of lead engine is electrically disconnected.

The Train Dispatcher will assign patrol trains to remove sleet from overhead catenary wires. When such trains are assigned, the following will apply:

1. Patrol trains consisting of MU equipment should have at least 5 cars with all pantographs in the raised position. In the case of heavy sleet, engineer may be instructed to cut out traction motors on the lead MU to reduce excessive arcing.
2. Patrol trains consisting of 2 or more electric locomotives shall run with both pantographs up on the leading engine (engineer should make certain that the lead pantograph is electrically disconnected), and rear pantograph up on trailing engines except through phase breaks or dead sections.

Electric locomotives and MU equipment in yards, on storage tracks, or standing at any point should have pantographs raised and lowered frequently to prevent accumulation of ice. In case pantographs operate sluggishly, instead of utilizing switches to remove ice accumulation, pantograph pole should be used to raise and lower pantographs for that purpose, avoiding contact of shoe with overhead wire.

While moving, when pantograph lowers due to sleet, or when ice build-up becomes excessive resulting in heavy arcing between shoe and wire, master controller must be shut off. An attempt must be made to raise and lower the pantograph several times. If this attempt fails, train must be stopped. If possible, stop should be made at a location where there is 5 feet or more between roof of equipment and wire. Attempt should be made again with pantograph pole as outlined above.

If all attempts by engineer fails to remove ice accumulation, Train Dispatcher must arrange for ice removal by Class A or Class B employee(s) as outlined in Section 5.13 and Section 5.14.

SECTION 3. INSTRUCTIONS PERTAINING TO TRAIN DISPATCHER AND TOWERPERSON EMPLOYEES

3.1 ARRANGING FOR PROTECTION OF TRACK SECTIONS.

Upon request from the Power Dispatcher, the Train Dispatcher will arrange for the necessary protection of track sections as designated by the Power Dispatcher. The Train Dispatcher must issue the applicable information to hold electric trains clear of the designated area by use of either a plate order (Form NEC-399) where plate orders are in effect, or Movement Permit Form D where plate orders are not in effect.

3.2 DE-ENERGIZING WIRES - USE OF PLATE ORDER FORM NEC-399.

Except in an emergency, in territory south of phase break where plate orders are in effect, a plate order Form NEC-399 must be used whenever it is necessary to de-energize catenary wire over any track section under the jurisdiction of the Train Dispatcher, Yard Supervisor, or other designated supervisor. The plate order must be made effective by the Train Dispatcher before the catenary wires are de-energized.

The Train Dispatcher must issue the plate order to all towerpersons who are involved with establishing the protection in accordance with the instructions contained on the plate order form. Once the Train Dispatcher has made the plate order effective, and has verified and recorded the application of blocking devices to switch and/or signal levers governing all routes to the affected track, the Train Dispatcher will notify the Power Dispatcher that the protection has been arranged and that the catenary may be de-energized. The Power Dispatcher will notify the Train Dispatcher of any temporary release request, and when power has been restored.

3.3 DE-ENERGIZING WIRES - USE OF MOVEMENT PERMIT FORM D.

Except in an emergency, in territory north of phase break where no plate orders are in effect, a Movement Permit Form D must be used whenever it is necessary to de-energize catenary wire over any track section under the jurisdiction of the Train Dispatcher, Yard Supervisor, or other designated supervisor. The Movement Permit Form D must be made effective by the Train Dispatcher before the catenary wires are de-energized.

The Train Dispatcher must issue the Movement Permit Form D to all towerpersons who are involved with establishing the protection. The Movement Permit Form D must specify to hold all electric trains (or all trains) at a specific location, or hold all electric trains (or all trains) from occupying a designated section of track. The section of track must be designated between two points where blocking devices can be applied, barricades erected, or temporary block stations (TBS) placed in service, or a combination of any two. Once the Movement Permit Form D has been made effective, and the Train Dispatcher has verified and recorded the application of blocking devices to switch and/or signal levers governing all routes to the affected track, the Train Dispatcher will notify the Power Dispatcher that the protection has been arranged and that the catenary may be de-energized. The Power Dispatcher will notify the Train Dispatcher when power has been restored.

SECTION 4. INSTRUCTIONS PERTAINING TO FACILITIES EMPLOYEES (EXCEPT E.T. PERSONNEL)

- 4.1 OPERATION OF MAINTENANCE OF WAY MACHINERY — BOOM EQUIPPED.** When rail-operated maintenance of way machinery which is equipped with a boom is used in electrified territory, it is the responsibility of the operator to know that the boom is properly grounded.

Such machinery must be operated so that the following clearance restrictions are observed:

With wires energized, or de-energized and NOT grounded

1. Whether or not supervised by a Class A employee, no closer than eight (8) feet from transmission wires or 24 KV feeders, and no closer than three (3) feet from catenary system and signal power wires.

With wires de-energized and grounded

1. When NOT supervised by a Class A employee, avoid contact with wire.

Energized conductors

1. If working within eight (8) feet of energized conductors, boom must be cowl (wire-guard) equipped.
2. If working within three (3) feet of energized conductors, the protection of a Class A employee is required.

- 4.2 OPERATION OF MAINTENANCE AND CONSTRUCTION ROADWAY MACHINERY.** When off-track or on-track mobile and crawler boom cranes, and similar roadway machines are used along the right-of-way in electrified territory near overhead electrification wires, power wires, and electrification apparatus, it is the responsibility of the operator to know that the boom and supporting frame of such machines are properly grounded. Equipment that is the property of others is subject to these same regulations.

Unless machine is properly grounded, and supervised by a Class A employee, such machinery must not be operated closer than eight (8) feet to overhead electrification wires, power wires, or electrical apparatus.

The location and working hours of all such machinery close to overhead electrification wires, power wires, and electrical apparatus must be reported to the Power Dispatcher.

If work is within eight (8) feet of an energized conductor, or if, in the opinion of the foreman or the operator, any hazard is involved, protection of a Class A employee must be requested.

- 4.3 OPERATION OF WRECK DERRICKS.** When a wreck derrick is necessary at a wreck or derailment, the wreck foreman will advise the Power Dispatcher who will promptly dispatch a Class A employee to the wreck. The Class A employee shall at once report to the wreck foreman. Should the wreck be of a serious nature, either a wire train or a wire truck shall also be dispatched, so that major electrical work made necessary by the wreck will be properly performed.

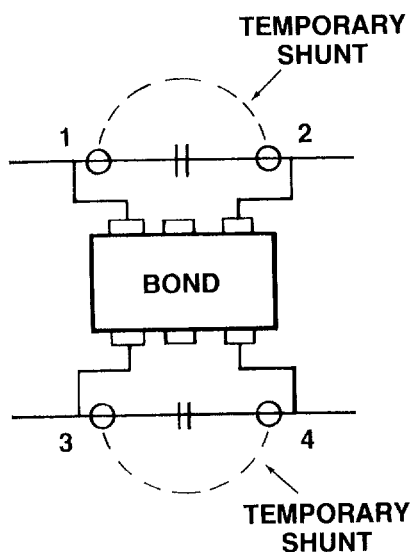
Where it is possible for the wreck derrick to come within eight (8) feet of transmission line or 24 KV feeder line, or within three (3) feet of catenary wire or signal power wire, the wires must be de-energized and properly grounded by a Class A employee.

If it becomes necessary for the wreck derrick boom to come in contact with de-energized/grounded wire, resulting in either upward or lateral pressure on wire, such operation shall be under the direction of a Class A employee.

Should it become necessary when operating wreck derrick to have the overhead wire drawn out of alignment or removed, the wire shall be de-energized and properly grounded, and the work done by or under the direct supervision of a Class A employee.

4.4 RENEWING IMPEDANCE BONDS. The function of impedance bonds, which are installed at the end of signal track circuits, is to allow passage of traction return current while blocking signal circuits.

Employees placing or renewing impedance bond leads shall take precautionary measures to protect themselves from electric shock due to the opening of the rail return circuit when impedance bond leads are disconnected. At certain times excessive potentials may exist between rail and disconnected bond lead; as a safety measure, all replacement work will be done with the bond leads shorted out as shown in the following diagram:



The diagram shows the method of installing shunts on a double bond. With the shunt installed in this manner, leads #1 and #2, or #3 and #4 may be disconnected and changed.

Employees replacing bond leads in accordance with these instructions should note that use of the shunts will cause signals to display their most restrictive aspects. Before work is begun, employee must first communicate with the Train Dispatcher to notify him/her of the work to be performed, and to coordinate the work with times that will least affect or interfere with normal train operation.

**SECTION 5. INSTRUCTIONS PERTAINING TO RAIL EQUIPMENT
DEPARTMENT EMPLOYEES (AND CLASS B EMPLOYEES)**

- 5.1 WORK UNDER OVERHEAD WIRES.** Work must not be done on electric equipment under overhead wires except by or under the supervision of a Class A or Class B employee.

All electric equipment must be considered to be energized except when it is known that pantographs are down and grounding switches are closed or that overhead wires are de-energized (dead) and properly grounded.

- 5.2 WORK ON CIRCUITS (GENERAL).** Work must not be done on any circuit of an energized multiple unit (MU) car except when the switch disconnecting the circuit is open. Fuses in heater circuit must not be replaced while pantograph is up.

When necessary to inspect or test a single energized circuit or a coupled energized circuit, a Class B employee must take charge, and others assisting with such work must be governed by his instructions.

- 5.3 REPAIR WORK ON OR NEAR MAIN POWER CIRCUITS/USE OF STANDARD WARNING TAGS.** Repair work on or near main power circuits on electric equipment must not be performed under energized wire until pantographs have been lowered, grounding circuits have been closed, and standard warning tags have been applied by employees doing work, except when another employee has been definitely assigned to prepare the cars for other employees who have been assigned to perform the work. In this case, before the employees who are assigned to perform the work may begin work, permission must be obtained from the employee who has applied the standard warning tags. The employee who applies the standard warning tags must then be informed when the work has been completed. Standard warning tags must be removed only by the employee who applied them. Grounding switches must not be opened until all tags are removed, and it is known that all persons are clear of main power circuits.

- 5.4 INSPECTION AND REPAIR WORK IN YARDS/USE OF STANDARD WARNING TAGS.** Inspection and repair work in yards shall be performed with the following procedure:

Under de-energized and grounded wire

An assigned Class A employee must de-energize and ground the overhead wire before any other employee may work on the equipment, except when permanently grounded section is provided.

The assigned employee must arrange for Blue Signal (blue flag, blue tag, blue light) protection as prescribed by NORAC Operating Rule 26 at the entrance to the inspection pit. Each employee must place his/her standard warning tag on the Blue Signal before starting to work. When work is completed, employee must remove his/her standard warning tag. After standard warning tags are removed, the assigned employee must know that all persons are clear before Blue Signal protection is removed.

The assigned employee may then remove ground and energize the overhead wire, except when dead section is provided.

Under energized wire

An assigned employee must lower the pantographs and close the grounding switches, and make certain pantographs are held down by latches.

The assigned employee's work is then governed by instructions as outlined in Section 5.3, except that employee must apply his/her standard warning tags before starting to work.

Assigned employee must know that all standard warning tags are removed, that all persons are clear, and that all tools and other working materials have been properly placed. The assigned employee may then open the grounding switches and raise the pantographs.

At all yard locations, except when otherwise specified, electric equipment ready for service shall be left with pantographs down, sufficient hand brakes applied, grounding switches open, and wheel chocks applied.

Pantographs must not be raised until it is known that all persons in the vicinity of the electric equipment are clear of all circuits and understand that the equipment is about to be energized.

When a defect develops in the main power circuits on electric equipment, pantographs must be dropped immediately if not automatically dropped. Pantographs must not be raised until it is safe to do so.

5.5 REMOVAL OF FUSES ON SILVERLINER IV PANTOGRAPH ASSEMBLY. Multiple Unit (MU) Silverliner IV equipment MA1F (car numbers 101-188, 270-399, 9018-9031) have high voltage primary fuses on the pantograph assembly. These fuses **MUST NOT** be removed under energized catenary.

5.6 CONTROL AND POWER JUMPERS ON SILVERLINER IV MARRIED PAIRS. Multiple Unit (MU) Married Pair Silverliner IV equipment MA1F (car numbers 101-188, 304-399) must have the pantograph lowered before control and power jumpers are applied or removed between the cars of a married pair.

5.7 MU AUTOMATIC COUPLERS. Multiple Unit (MU) cars with automatic couplers need not be de-energized or pantograph lowered when interrupting trainline circuits through electric heads.

All permanently extended pins on electric heads of couplers must be considered energized.

5.8 EMERGENCY REPAIR WORK. Only Class A or Class B employees are permitted to occupy the top of any equipment which is under overhead catenary wire for emergency repair work of any nature, and/or for the purpose of preparing equipment for subsequent movement to a repair location.

5.9 OCCUPYING ROOF OF EQUIPMENT IN TUNNELS. In tunnel areas, catenary must be de-energized and grounded, and pantograph lowered and grounded before going onto the roof of equipment.

5.10 OCCUPYING ROOF OF EQUIPMENT TO SECURE/ REMOVE BROKEN PANTOGRAPH. Before Class A or Class B employee occupies the roof of equipment to remove

or secure a broken pantograph, the following conditions must be met:

1. Overhead wire has been de-energized and properly grounded.
2. Position of overhead wires has been noted and other wires within three (3) feet of the work area have also been de-energized and properly grounded.
3. Standard warning tag, properly filled out, has been applied to handles of all grounding switches closed for protection.
4. All equipment capable of holding a static charge (i.e. main transformer) in the main power circuit has been grounded.

After all persons have descended from the roof of the electric equipment, the standard warning tags must be removed by the persons who applied them before grounding switches are opened.

5.11 OCCUPYING ROOF OF EQUIPMENT UNDER ENERGIZED/ UNGROUNDED WIRE. Anytime Class A or Class B personnel are required to go onto the roof of electric equipment under energized or ungrounded catenary, the following procedure must be followed:

1. All pantographs on the train must be lowered and latched, and at least one (1) DOWN Pantograph button must be switched to the "down" position.
2. The grounding bar (switch) on the car to be climbed must be closed in the "grounded" position.
3. Silverliner IV equipment MA1F (cars 101-188 and 304-399) have a high voltage bus jumper on the "A" ends connecting the pantograph on the "B" cars to a high voltage pothead on the "A" cars. When the pantograph on the "B" car is in the "up" position, both pantograph and pothead are energized, unless the jumper is physically removed from between the cars and the pantograph is "down" and "grounded".

5.12 RENEWING PANTOGRAPH SHOES IN AN EMERGENCY.

Only in an emergency may pantograph components be renewed by Class A or Class B employees under energized catenary wire, and then only at locations where wire is five (5) feet or more above the pantograph lock-down height of car.

5.13 RENEWING PANTOGRAPH SHOES — WIRE HEIGHT 5 FEET OR MORE. Where overhead catenary wire remains energized, when renewing pantographs where the height of the wire is five (5) feet or more above the pantograph lock-down height, the following procedure must be followed:

1. Before occupying roof or touching any part of pantograph assembly:
 - a. Full control air pressure must be obtained.
 - b. Battery switches must be closed.
 - c. Pantograph trainline DOWN Pantograph switch must be in the "Down" position.
 - d. All pantographs must be held down by latches.
 - e. All grounding switches must be closed and making proper contact, and locking pins inserted where provided.
 - f. Standard warning tag, properly filled out, must be applied to grounding switch handles.
 - g. The position of overhead wire must be noted.

2. While working on the roof:
 - a. Keep at least three (3) feet from all wires, and take additional care when equipment is of the Silverliner IV type MA1F (car numbers 101-188, 9018-9031) and type MA1E & MA1F (car numbers 270-399) which have dynamic brake grids on the roof and may be extremely hot.
 - b. Stand astride pantograph tubing so it cannot raise, but do not bear excessive weight on tubing which might throw it out of position.
 - c. Do not work directly under the wires.
 - d. Do not up-end the pantograph shoe. Always lay shoe on pantograph tubing in a horizontal position and slide into, or out of place.
 - e. Before descending, be sure that all pantographs are held down by latches, grounding switches are closed, and all tools have been removed.
3. After all persons have descended from the roof:
 - a. Standard warning tags must be removed from grounding switch handles by persons who applied them.
 - b. Keep as far as possible from all normally energized parts.
 - c. Open grounding switches.
 - d. Prepare electric equipment for service.

5.14 RENEWING PANTOGRAPH SHOES — WIRE HEIGHT LESS THAN 5 FEET. At locations where overhead catenary wire is less than five (5) feet above the pantograph lock-down height, pantograph shoes must not be renewed until overhead wires have been de-energized and properly grounded.

5.15 TRACTION POWER AND MU EQUIPMENT FAILURE IN YARDS. Whenever equipment trouble in any yard causes the power supply to fail, the Power Dispatcher must immediately be notified.

Power in the overhead wires is indicated by the running of the blower at all times when the pantograph is raised against the wire. In certain cases, however, an individual Multiple Unit (MU) car may be inoperative due to the blower motor circuit breaker being tripped or the MA set shut down. In these cases, blowers running on adjacent cars will indicate that wires are energized. Individual AEM-7 electric locomotives are designed to revert to a "layover" mode under certain conditions, and therefore should not be relied upon to determine if overhead catenary power has failed.

5.16 CAUSES OF TRACTION POWER AND MU EQUIPMENT FAILURES — GENERAL INFORMATION. Power failures may be due to a number of causes. Following are the most common causes:

1. Trouble on the overhead wires themselves, which can result from foreign objects contacting the wires and at the same time coming in contact with catenary supports, the ground, or a car roof. Overhead wires may be broken and lying on the roof of a car or on the ground.
2. Foreign objects such as birds, loose wires, tree branches, etc. may come into contact with the pantograph and the car roof.

3. Failure of some part of the high voltage electrical equipment of the car such as the high tension lead to the transformer or failure of the transformer itself.

Any of the above will cause a short circuit between the overhead wires and ground resulting in failure of power supply to the entire yard or section or wiring on which the condition prevails.

5.17 FAILURE OF CAR TRANSFORMER. The failure of Multiple Unit (MU) car transformer can take place as the pantographs are raised against the wire, or any time thereafter. At such times a noise similar to a torpedo may be heard, or a flash may be seen. Protective devices have been provided on the cars to lower pantographs. In the event of a transformer failure, the operation of the pantograph depends upon air pressure. When a transformer failure occurs on a car before the air pressure has built up, the pantograph WILL NOT "lower" automatically. It would be necessary, therefore, to pull the pantograph down with the hookstick whenever failure occurs under these circumstances.

5.18 PROCEDURES TO BE FOLLOWED IN CASES OF POWER FAILURE. Whenever power fails due to any of the above causes, R.E.D. personnel should proceed as follows:

1. Immediately lower the pantographs on the car or cars on which the trouble has occurred.
2. Notify the Power Dispatcher immediately, reporting exactly what has happened.
3. Visually inspect the train and catenary from the ground for the cause of the problem looking for broken wire, broken pantograph, foreign objects, etc.
 - a. If a transformer has flashed and the pantograph has remained in contact with the wire, this may be detected by watching for smoke coming from under the car or by the presence and/or smell of transformer oil. Avoid contact with the transformer oil.
 - b. The pantograph lowering relay (PLR) may be checked to determine if it has tripped.
4. If the cause of the trouble cannot be located by inspection, arrange with the Power Dispatcher to test all cars in the following manner:
 - a. Start with all pantographs in the yard in the down position.
 - b. Raise the pantographs on each car one at a time listening to determine if power is on after raising each pantograph.
 - c. As the pantograph on the bad car is raised, power will fail and the blowers on all cars will stop. When this happens, pull pantograph down on this car with a hookstick. Report immediately to the Power Dispatcher to have power restored to the section.
5. Remove the cause of trouble if possible. Make a visual inspection of the car roofs from the ground. If foreign object is noticed, attempt to remove it using hookstick leaving the pantograph down. Do not climb on roof of car unless a Class A or Class B employee. If able to remove the foreign object, report immediately to the Power Dispatcher when the object has been removed so that power may be restored to the section. If unable to remove the foreign object, report immediately to the Power

Dispatcher who will dispatch qualified employees to remove the object.

6. If trouble persists, car must be taken out of service and a report made to all concerned. Report the car number and the cause of trouble to the Power Dispatcher who will report it to the Foreman of the Electric Car Shop. Notify all train crews working in the area as to the car defect.

5.19 INSTRUCTIONS FOR REMOVING SLEET FROM PANTOGRAPHS. If the accumulation of ice on a pantograph is such that equipment can only be operated by removal of ice, the following applies:

1. When the energized wire is less than five (5) feet from the roof of equipment, Train Dispatcher must arrange for the necessary protection.
2. When the energized wire is more than five (5) feet from the roof of equipment, the procedure outlined for "Renewing Pantograph Shoes" must be followed. In addition, ice must be removed from step treads leading up to roof to insure safe footing and extra precautions must be taken against slipping once occupying roof. To avoid damage, other parts (i.e. tubing, rods, shoes) must be tapped lightly to remove ice.

At terminals, a sufficient number of Class A or Class B employees should be made available to remove ice from pantographs. When work is performed under energized wires, and work is of the magnitude to require a number of work groups on different equipment, the supervisor in charge shall designate one individual in charge of each group to be responsible for knowing that each member of the group follows the proper procedure outlined above.

When request is made to stop ice removal for the purpose of inspection by the designated qualified employee, the pantograph shall be lowered, and the DOWN Pantograph switch remain in the down position until the inspection has been completed.

5.20 SAFETY INSTRUCTIONS. The following Safety Instructions pertain to employees who are working in electrified territory or handling electric equipment or apparatus:

- a. Only qualified individuals who have full knowledge of operating voltages and service handled are permitted to work on or about electric circuit apparatus, and then only if authorized to do so.
- b. Only tools (including rope, tape, and flashlight) which have been approved for use on that particular circuit are permitted for work.
- c. Insulation, weather proofing, or covering on wire, electrical apparatus, or equipment must not be depended upon for protection against shock.
- d. Rubber gloves must be worn when removing or replacing fuses, or operating disconnect switches. In addition, when handling voltages listed below, other protection must also be used as designated.

VOLTAGES**PROTECTION**

175 to 400 volts

Electrical protective gloves.

400 to 2,500 volts

De-energize, ground, and work between two grounds; if not practicable, obtain permission of E.T. Supervisor (unless Foreman, Electrician is in charge) and use electrical protective gloves and approved protective devices.

2,500 to 70,000 volts

De-energize, ground, and work between grounds.

70,000 or more volts

De-energize and ground all circuits on the same pole or structure before working on any of them, unless structure provides at least eight (8) feet clearance from any energized circuit.

SECTION 6. EXTINGUISHING FIRES AROUND ELECTRICAL WIRES, POWER WIRES, OR ELECTRICAL APPARATUS.

- 6.1 FIRE EXTINGUISHERS — GENERAL.** Fire extinguishers should be ready for service at all times. Employees should familiarize themselves with the location of fire extinguishers in and around their work area. The operation and types available are contained in the Timetable Special Instructions.
- 6.2 FIRE NEAR ELECTRICAL WIRES.** Fires near overhead wires may interrupt power and must be reported immediately to the Train Dispatcher who will advise the Power Dispatcher. When necessary, the Power Dispatcher will send a Class A employee to the scene of the fire. If fire-fighting apparatus, hose streams, etc. may come in contact with the overhead wires, power must be removed. If grounding of the wires is necessary, it must be done by a Class A employee.
- 6.3 FIRE ON ELECTRICAL EQUIPMENT OR APPARATUS.** In case of fire on electrical equipment or apparatus, the power must be removed immediately. The circuit must be grounded, if possible, before using fire extinguishers. If the extent of the fire requires calling private or public fire departments, they must be advised whether the equipment or apparatus is energized, de-energized and not grounded, or de-energized and grounded.
- 6.4 HIGH VOLTAGE CONDUCTORS.** During a fire, all persons must keep as far as possible from energized high voltage conductors which might fall. Arrangements must be made to have such wires de-energized and grounded. (WARNING: Catenary and transmission conductors are strung under high mechanical tension. Physical failure will result in dangerous "whipping".)
- 6.5 USING FIRE EXTINGUISHERS.** When using fire extinguishers, all electrical apparatus and wires must be considered energized until it is known that proper grounds have been applied. The safe distances from wires specified in this publication must be maintained. When discharging an extinguisher on a fire, the contents should be directed at the base of the flames. After its use, a report should be made to the proper authority and the extinguisher recharged immediately.
- 6.6 FIRE EXTINGUISHERS APPROVED FOR ELECTRICAL FIRES.** Use only fire extinguishers approved for fires around electrical circuits. The use of other types of fire extinguishers is prohibited.
- 6.7 FIRES INVOLVING OIL FROM CIRCUIT BREAKERS OR TRANSFORMERS.** Fires involving oil from circuit breakers or transformers may cause burning oil to be thrown on other electrical apparatus, and to flow through indoor floor openings. Carbon Dioxide, or Dry Chemical type extinguishers should be used for first application, followed by the use of sand or earth to prevent fire spreading on the floor or ground.

SECTION 7. CATENARY TO RAIL CLEARANCE AT BRIDGES.**7.1 AIRPORT LINE**

Location	Single Track	No. 1 Track	No. 2 Track
58th Street	16'-0"		
Lindbergh Blvd.	18'-5¼"		
61st Street		19'-1¾"	19'-1¾"
63rd Street		19'-1"	19'-0"
70th Street		19'-0"	19'-0"
Island Road		18'-6"	18'-2"
84th Street		20'-3"	20'-6"
Ramp "A" Airport		17'-0"	17'-0"
Ramp "L" Airport		16'-6"	16'-6"
Pedestrian Bridge "A" to end of track		16'-0"	16'-0"

7.2 CHESTNUT HILL EAST LINE

Location	No. 1 Track	No. 2 Track
Mt. Airy Avenue	17'-2"	17'-5"
Gravers Lane	17'-2"	17'-0"
Gowen Avenue	16'-5"	16'-10"
Summit Avenue	16'-4"	16'-9"
Evergreen Avenue	Not Attached	

7.3 CHESTNUT HILL WEST LINE

Location	No. 1 Track	No. 2 Track
Budd Building	18'-6"	18'-9"
Abbotsford Avenue	17'-6"	17'-5"
Wissahickon Avenue	15'-10"	15'-10"
Queen Lane	16'-3"	16'-3"
Queen Lane Foot Bridge	Not Attached	
Coulter Street	15'-6"	15'-10"
Morris Street	16'-0"	16'-0"
School House Lane	16'-3"	16'-7"
Chelten Avenue	16'-3"	16'-3"
Walnut Lane	16'-2"	16'-1"
Wayne Avenue	16'-0"	16'-0"
Foot Bridge	16'-7"	16'-5"
Johnson Street	16'-5"	16'-5"
Allen Lane	16'-0"	16'-1"
Willow Grove Avenue	15'-8"	15'-4"
Hartman Lane Foot Bridge	15'-11"	16'-3"
Highland Avenue	16'-2"	16'-7"

7.4 CR TRENTON/FOX CHASE LINE

Location	Single Track	No. 1 Track	No. 2 Track
Olney Avenue		19'-1"	19'-2"
Levick Street		20'-8"	20'-11"
Martins Mill Road/ Old Soldiers Road	17'-8"		
Pine Road	18'-9"		

7.5 MAIN LINE/DOYLESTOWN LINE

Location	No. 1 Track	No. 2 Track	No. 3 Track	No. 4 Track
Broad and Lehigh	16'-10½"	16'-9"	16'-8"	16'-8"
Glenwood Avenue	18'-4"	18'-7"	18'-4"	17'-0"
American Express	17'-1"	17'-8"	17'-6"	16'-9"
Amtrak Main	16'-5"	16'-4"	16'-2"	16'-1"
Chestnut Hill West (Lower)	16'-3"	16'-5"	16'-1"	16'-1"
Indiana Avenue	16'-5"	16'-4"	16'-1"	16'-4"
Chestnut Hill West (Upper)	16'-1"	16'-0"	16'-4"	16'-2"
66th Avenue	16'-10"	16'-5"		
Oak Lane	17'-4"	17'-1"		
Prospect Avenue Foot Bridge	20'-8"	20'-6"		
Union Avenue	20'-8"	20'-6"		
Church Road	20'-11"	20'-3"		
Summit Avenue	17'-7"	17'-4"		
Bridge Street, Oreland	18'-2"	18'-3"		
Bethlehem Pike, Ft. Washington	17'-2"	17'-5"		
Church Road, N. Wales	16'-11"	17'-0"		
PA Avenue, N. Wales	19'-6"	19'-10"		
	Single Track			
Route 152 (Main Street, Chalfont)	16'-6"			

7.6 IVY RIDGE LINE

Location	Single Track
City Line Avenue	17'-9"
Union Avenue	17'-8"
Montgomery Avenue	18'-1"
Belmont Avenue	20'-3"

7.7 NESHAMINY LINE/CR TRENTON LINE

Location	No. 1 Track	No. 2 Track	Siding Tracks	Single Track
Walnut Street	21'-0"	20'-11"	21'-2"	21'-2"
York Road	16'-10"	16'-11"		
Huntington Pike	20'-3"	20'-1"		
Bustleton Pike	20'-0"	19'-10"		
PA Turnpike	22'-6"	22'-1"		
Street Road	22'-2"	21'-2"		
Old Street Road	21'-2"	20'-2"		
Humeville Road	20'-0"	20'-0"		20'-0"
Route 213	20'-4"	20'-3"		20'-4"
I-95/Route 1 Connection	21'-4"	21'-0"		21'-7"
CR Trenton Cut-Off	17'-8"	17'-11"		18'-3"
I-95 South	20'-5"	19'-7"		
I-95 North	20'-6"	20'-3"		

7.8 NORRISTOWN LINE

Location	No. 1 Track	No. 2 Track
Indiana Avenue	16'-0"	16'-0"
Fox Street	16'-7"	16'-8"
Henry Avenue	17'-8"	17'-7½"
Calumet Street	16'-10"	16'-10"
Ridge Avenue	17'-3"	17'-3"
Dawson Street Foot Bridge	16'-11"	16'-10"
SEPTA Ivy Ridge Line	17'-2"	16'-9"
Fayette Street, Conshohocken	21'-6"	21'-6"
Allenwood Steel	Not Attached	Not Attached
Norristown HSL	18'-11"	
Route 202	21'-7"	
CR Bridge, Norristown	20'-3"	

7.9 WARMINISTER LINE			
Location			Single Track
CR Trenton Cut-Off			17'-5"
PA Turnpike			Not Attached
Welsh Turnpike			Not Attached
7.10 WEST CHESTER LINE			
Location	Single Track	No. 1 Track	No. 2 Track
47th Street		17'-5"	17'-8"
Woodland Avenue		16'-8"	16'-8"
Kingsessing Avenue		16'-5"	16'-7"
49th Street		16'-8"	16'-5"
Chester Avenue		16'-5"	16'-4"
Warrington Foot Bridge		17'-1"	17'-2"
52nd Street		16'-9½"	17'-2"
Whitby		17'-0"	16'-10"
Thomas Avenue		17'-9"	17'-10"
57th Street		18'-0"	17'-7½"
58th Street		18'-5"	17'-8"
Church Road		18'-3"	17'-10"
Lansdowne Avenue		20'-7"	20'-6"
College Avenue		17'-6"	18'-0"
Wallingford Foot Bridge		19'-6"	19'-5"
Providence Road		16'-11"	16'-9"
Orange Street	17'-7"		
Mermaid Lane	17'-2"		
Route 352	22'-6"		
Route 452	18'-3"		
Westtown	16'-10"		
Route 202	19'-6"		
Off Bolar Road	17'-1"		

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SECTION 8. FIRST AID INFORMATION.

(NOTE: The information contained herein is not intended to be a comprehensive first aid manual, but rather as hints on first aid to the injured.)

8.1 GENERAL INSTRUCTIONS. In any injury, the following should be done at once, as indicated:

1. In other than minor injuries, send for medical assistance as soon as possible.
2. Control bleeding and apply dressing.
3. Restore breathing.
4. Keep injured quiet.
5. Protect from excessive heat or cold.

8.2 OPEN WOUNDS — BLEEDING. The following should be done at once:

1. Expose wound.
2. Apply sterile or clean dressing and bind in place.
3. Apply pressure to large, spurting arteries to stop hemorrhage, place compresses on the bleeding part and tie in place with the bandage; if bleeding continues, apply more compresses and more pressure until it stops. If this fails, tie a bandage around the limb between the point of hemorrhage and the body, and twist with a stick until bleeding stops. Pressure should be released for five minutes every twenty minutes. Send for medical assistance as soon as possible.

8.3 BROKEN BONES. The following should be done at once:

1. Do not move unnecessarily.
2. If neck or back injury is suspected, keep patient absolutely flat.
3. Control bleeding.

8.4 GAS POISONING. The following should be done at once:

1. Secure ventilation promptly.
2. Remove from gas atmosphere.
3. Restore breathing by artificial respiration.
4. Maintain warmth.

8.5 DROWNING, SUFFOCATION, LOSS OF CONSCIOUSNESS.

The following should be done at once:

1. Restore breathing by artificial respiration.
2. Maintain warmth.

IMPORTANT IN DROWNING VICTIMS

Get air into the lungs of the victim without delay. There may or may not be water in the lungs, nor is this of primary importance since water cannot be removed from the lungs satisfactorily. Do not waste valuable seconds turning the victim to clear the lungs or to empty the stomach. Proceed immediately with artificial respiration.

8.6 RESUSCITATION FROM ELECTRIC SHOCK AND APPARENT DEATH. The following are general instructions:

1. The general use of electricity about railroad property makes it desirable that all employees should be trained to

render intelligent assistance in electric accidents. Supervisors, Class A, B, and other employees must be given instructions and should qualify in the methods to be followed and the precautions to be observed. In the event of an accident, one employee should take charge and select as assistants only those most likely to remain calm and dependable.

2. Artificial respiration, or forced breathing, is usually required for electric shock, or asphyxiation by gases in manholes or resulting from the use of fire extinguishers in confined spaces; in other words, in all cases in which breathing is temporarily suspended.
3. Restoring natural respiration is necessary for successful results. While promptness is essential, undue haste should be avoided. The failure of the victim to respond quickly to resuscitation should not cause discouragement; the effort should be continued because:
 - a. The body depends upon a continuous exchange of air. We must breathe in and out about fifteen times per minute.
 - b. If the body is not repeatedly supplied with air, suffocation occurs.
 - c. Persons whose breathing has been stopped have been restored after artificial respiration has been continued for as long as three hours or more.
4. Electric shock is not always fatal; it may only stun the victim and stop his breathing. Send for a rescue squad promptly and put the case in their hands upon their arrival. However, since the brain cells begin to die after 4 minutes without oxygen, artificial respiration must be started immediately after the body is released from contact with a live conductor. Do the following:
 - a. Break contact.
 - b. Restore breathing by artificial respiration.
 - c. Maintain warmth.

8.7 RELEASING VICTIM FROM CONTACT WITH A LIVE CONDUCTOR. Extreme care must be exercised in releasing a victim from contact with a live conductor, as potential exists for rescuer to receive shock. The following steps must be taken to assure safety:

Release of victim — known voltage 750 or less

1. Do not touch the live conductor.
2. Do not touch the victim's bare skin while in contact with the live conductor.
3. Use a piece of DRY non-conducting material such as a piece of wood, rope, or a coat, to push or pull the live conductor away from the victim. The live conductor may be handled safely with rubber gloves.
4. If the victim's clothing is dry, victim should be dragged away from the live conductor by grasping clothes, NOT BARE SKIN. In doing this, the rescuer should stand on a dry board and use only one hand. Do not stand in a puddle of water or on damp or wet ground.

Release of victim — known voltage 750 or more

1. Do not touch the live conductor.
2. Do not touch ANY part of the victim as long as victim is in contact with the live conductor.
3. Use an insulated pantograph, or switch pole to push the wire away from the victim. Keep the hands at least eight feet away from the victim and wire when doing this.

Insulated poles may be found in all substations, wire trains, and at communication and Signal Foreman's Headquarters, E.T. Foreman's Headquarters.

4. If such a pole is not available, get the wire de-energized as promptly as possible. Notify the Power Dispatcher, nearest signalman, or electrician before attempting to release the victim. When Power Dispatcher indicates that power has been removed, then use a dry piece of wood, a rope, or coat to push or pull the conductor away from the victim.
5. If the victim or the live wire is in a pool of water, do not step into the water. Remove the victim or the live wire with the pole.

When handling a live wire or other conductor, be careful that it does not come in contact with yourself or bystanders. Send for rescue squad, or, if victim is conscious and able to be transported, take to Emergency Room of nearest hospital.

8.8 POLE TOP RESCUE. The following are basic steps involved in pole-top rescue:

1. **EVALUATE** — Shout the victim's name. Is victim unconscious? Is victim contacting an energized conductor? Summon help.
2. **PROTECT YOURSELF** — Remove all serious hazards and wear necessary protective equipment.
3. **CLIMB TO RESCUE POSITION** — Above the victim unless victim is in contact with energized conductor. Belt in before attempting assistance. Clear the energized facility.
4. **DETERMINE VICTIM'S CONDITION** — Is victim breathing? If not, immediately clear victim's mouth, position head and ventilate with four quick full breaths. First aid aloft should be kept to a minimum.
5. **LOWER THE INJURED** — Attach load line to the injured, high under both armpits, using three half hitches. Slide hitches tight against victim's chest and close to one armpit. Check that lines will not bind. Take slack out of line and maintain firm grasp on fall line. Cut the injured's belt. Lower victim quickly, but carefully.
6. Continue resuscitation until help arrives. Accompany the injured to hospital for a complete evaluation.

8.9 CARE OF VICTIM — BURNS AND SCALDS. Following is general information for first aid treatment for burns and scalds:

1. Wherever and whenever possible, apply cold water compresses, or submerge the burned area in cold water until pain subsides.

2. If an electrical burn, there may be two burn areas. The current can enter the body in one place and leave by another, burning each area. Be sure to look for a second burn area.
3. A raw blistered surface should be protected from the air. If clothing sticks, cut around it; do not peel it off. Burns should be kept clean by applying sterile gauze compresses from the First Aid Kit, only for protection against infection. Cover the dressing with cotton, gauze, lint, clean handkerchiefs, or other soft cloth, and hold lightly in place by a bandage.
4. Similar coverings should be lightly bandaged over dry, charred burns, but without applying oil or other liquid dressing.
5. Send for rescue squad, or, if conscious, and able to be transported, take to Emergency Room of nearest hospital.

8.10 RESTORATION OF BREATHING BY ARTIFICIAL RESPIRATION — GENERAL INSTRUCTIONS. The following are general instructions:

1. If the victim can be made to breathe, the major part of resuscitation has been accomplished. Having freed the victim from contact with the live conductor, start artificial respiration immediately.

2. Do not wait for rescue squad. Do not stop to loosen victim's clothing unless it is obvious that this is necessary. Every moment of delay lessens the chance of recovery.

If absolutely necessary, resuscitation may be delayed for a few seconds to carry the victim to a convenient spot, or to remove victim from a train, or to an ambulance. Mouth-to-mouth resuscitation can be continued even while moving the injured individual.

Bystanders should not be allowed to gather about the injured person.

3. If the accident happens on a train, quickly move the victim to any area where enough space is available for resuscitation. Open doors to admit fresh air.

When necessary, have someone radio ahead and make arrangements for an ambulance to meet the train at the most convenient station or crossing.

If the accident happens on the right-of-way or in a shop area, don't move the victim unless the location is unsafe; proceed with resuscitation. Have someone immediately arrange for ambulance or other suitable transportation to the nearest medical aid.

4. During the period of resuscitation, keep the victim warm if at all possible.
5. In handling the victim, try not to touch or irritate burned parts, and during artificial respiration, see that pressure is not brought to bear upon burns.
6. When natural breathing has been restored, the victim should be watched carefully to see that victim does not overexert self. Violent exertion may cause a cessation of breathing, lessening chances of recovery.

7. **DON'T STOP.** Continue artificial respiration until the victim breathes normally, a doctor declares victim dead, or victim's joints stiffen.

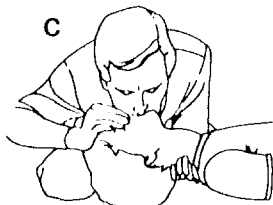
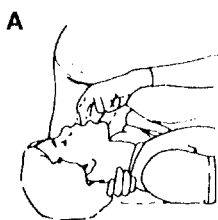
8.11 MOUTH-TO-MOUTH METHOD OF ARTIFICIAL RESPIRATION.

Experiences and experimental tests have clearly proven that mouth-to-mouth breathing is the most efficient form of artificial respiration. Using this method, it is possible, during the whole procedure, to see that the lungs of the casualty are inflated. It can be easily seen that air readily goes in and out of the lungs of the casualty. This assures the efficiency of the artificial respiration.

Proceed as follows: **MOVE FAST! SECONDS COUNT WHEN A PERSON IS NOT BREATHING. DON'T TAKE TIME TO MOVE VICTIM UNLESS LOCATION IS UNSAFE.**

The four-step procedure for giving artificial respiration is demonstrated.

- Lay victim on back on a firm, rigid surface. Quickly clear the mouth and airway of foreign material.
- Tilt the victim's head backward by placing one hand beneath the victim's neck and lifting upward. Place the heel of the other hand on the victim's forehead and press downward as the chin is elevated.
- With the hand on the victim's forehead, pinch victim's nostrils using your thumb and index finger. Take a deep breath. Place your mouth tightly around the victim's mouth and give four quick breaths. Then give approximately 12 breaths per minute — one breath every five seconds until you see the victim's chest rise.
- Stop blowing when the victim's chest is expanded. Remove your mouth from the victim's and turn your head toward the victim's chest so that your ear is over the victim's mouth. Listen for air leaving the lungs and watch chest fall. Repeat breathing procedures.



8.12 MOUTH-TO-NOSE METHOD OF ARTIFICIAL RESPIRATION.

It may be difficult to use the mouth-to-mouth method in any of the following circumstances:

1. If there has been severe injury to the mouth region.
2. If an air-tight seal cannot be obtained for the mouth-to-mouth method because of the patient's large mouth, absence of teeth, or other reason.

The mouth-to-nose method is an excellent alternative to the mouth-to-mouth technique.

If attempts at blowing air into the mouth fail, immediately attempt mouth-to-nose exhaled-air ventilation by the following routine:

1. Close the mouth with one hand and hold the lips sealed with your thumb on the patient's lower lip.
2. Take a deep breath, seal your mouth to the patient's nose and blow air into his lungs. The seal around his nose must be wide enough to enclose his nostrils completely.
3. Once the airway has been established from the nose to the lungs, the procedure is the same as mouth-to-mouth.

8.13 HEART STOPPAGE (CARDIAC ARREST). Whether heart stoppage is due to electric shock or other cause, the following steps should be taken:

1. Check for any pulse (wrist, carotid at angle of neck and jaw, etc.)
2. Feel/put ear against chest-listen for heart beat
3. If no pulse, no heart beat, no chest movement, proceed as follows, immediately:
4. Call or send for emergency medical rescue unit (police, fire department or other)

IF ANYONE PRESENT IS QUALIFIED/CERTIFIED IN CPR (CARDIO-PULMONARY RESUSCITATION) TECHNIQUE, BEGIN CPR UNTIL EMERGENCY MEDICAL RESCUE UNIT ARRIVES.